

BEDEO

Accelerating the Transition: Supporting our Businesses

Enabling Low-Emission Fleets with Retrofit Electrification

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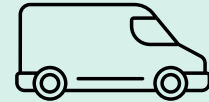
Introduction

As the UK charts its course toward a net-zero emissions future, it is imperative to address road-transportation emissions by all possible measures. We suggest greater consideration for retrofit electric vehicle technology – which ultimately also supports our country’s many SMEs.

The necessity for a transition to electric mobility is self-evident across all vehicle classes. But at current adoption rates, even the declared internal-combustion-engine vehicle phase-out deadlines won’t be soon enough to achieve our country’s net zero ambitions: from 2035, the sale of new liquid petroleum gas, petrol and diesel cars, as well as hybrid vehicles, will be banned across the UK. The sale and purchase of second-hand internal combustion engine (ICE) and hybrid cars will still be allowed.

Given the average age of all vehicles on UK roads has now hit a record 8.4 years, it’s clear that a significant portion of diesel vehicles registered from now up to 2035 will continue to ply roads throughout the 2040s and beyond¹. This situation is even more pronounced among light commercial vehicles (LCVs) with the average age of light commercial vehicles in the EU is 12 years, with the UK’s average van fleet age at 9.3 years².

The focus of much of the public dialogue, grants and incentives is around passenger cars. More focus is needed on LCVs. As of March 2020, there were 4.1 million licensed vans on the roads in Great Britain, collectively covering 55.5 billion miles. Given that these vans have a potential lifetime mileage of over 200,000 miles, and new ICE vans will keep being manufactured until 2035 – and potentially beyond that – large vans will continue to emit greenhouse gases well past 2040.³



4.1 Million
the current UK van fleet



9.3 Years
the average age of light commercial vehicles on our roads



“Retrofit electric vans represent a pivotal *third way* to achieving sustainable van fleets, and our country’s net-zero ambitions.”

Osman Boyner
Founder, BEDEO

Introduction

Greater encouragement for electrifying vehicles would seem to be necessary to reduce harmful emissions. But at the same time, the principles of the circular economy emerge as guiding beacons, emphasising the reduction of waste and embedded carbon. Adopting a circular economy ethos also mandates extending the lifecycle of existing and promoting the use of local solutions to minimise global transport emissions reduce and embedded carbon.

The current challenge, taking everything into account, is how we accelerate electrification and at the same time, integrate a circular economy logic into the acceleration.

Presently, fleet owners face a choice: invest in electric vans, continue operating current diesel vehicles until the end of their lifecycles or buy a new/second-hand diesel van, thereby tolerating their non-compliance with emissions-reduction.

We propose a transformative approach: “Reborn Electric”, otherwise known as electric retrofit.



Introduction

Retrofitting existing vehicles with electric drivetrains minimises environmental impact by maximising the value extracted from the total package. By extending the lifespan of a van with solutions developed within the UK, it's possible to electrify a fleet, curb unnecessary waste and transport, and support the national economy at the same time.

Retrofit electric vans represent a pivotal “third way” to achieving sustainable van fleets, and a faster transition to net-zero for the UK. A study carried out by ADEME (the French Environment and Energy Management Agency) suggests that depending on the vehicle, 66 to 87 percent of greenhouse gases can be saved when a vehicle is retrofit⁴.

Not only does retrofitting electric vans yield environmental benefits, it also presents a compelling business case for fleets. By extending vehicle lifespans and leveraging electric propulsion, fleet operators can achieve significant cost savings over the vehicles' operational lifetimes. Moreover, retrofit electric vans offer drivers a seamless, emissions-free driving experience, this can also be complemented by a range-extender, a reliable way to mitigate range anxiety and dependency on public chargers.



66 to 87%

of greenhouse gases can be saved when a vehicle is retrofit



“When you buy a new van, you have a high degree of embedded carbon. Here, we are taking a vehicle that has already been built, and making it last longer.”

Explains **Andrew Whitehead**, CEO, Protean Electric – part of BEDEO Group

Comparing a diesel van to a Reborn Electric retrofit-hybrid electric van running costs over a three-year period (at 20,000 miles p.a.):

Diesel: At an average of 23.5 mpg and a fuel cost of £1.54 per litre, and an annual service of £450, the total cost amounts to **£18,900**.

Reborn Electric: At 20% driving with diesel and 80% in electric mode, the same diesel costs, electricity charges of £0.20 per kWh and an annual service fee of £250, the total cost is around **£8,700**.

The UK Van Fleet

About one in eight vehicles on the roads in the UK is a van; close to five million vans are registered, at an average age of 9.3 years⁵. At the end of the first quarter of 2024, new van sales even showed an 11 percent year-on-year increase, with demand particularly strong for larger models⁶.

Notably, according to a BEDEO survey, 9 out of 10 fleets have vans with custom fitouts like refrigeration units, specialised racking systems, or passenger transport accommodations including wheelchair lifts. The same study indicated an average cost of a new UK large van, including conversions, to be around £43,000 – a significant investment, especially for SMEs. Fully fitted out, some vans can amount to over **£70,000**.

Yet fleet-operating businesses are increasingly motivated to transition to electric fleets before the mandated deadlines. The pursuit of Environmental, Social, and Governance (ESG) goals as well as achieving net-zero ambitions are driving this transition, as is simple economics. The reduced servicing costs, lack of fuel use, and avoidance of some congestion charges together leads to a lower total cost of ownership (TCO) for electric vans.

Despite this, while BEVs accounted for one in six vehicles registered in the UK in 2023, and were particularly popular among fleet operators, fully-electric vans make up just over 5 percent of new registrations, and even less than that for larger vans. This clearly indicates a particularly slow transition to full electrification for the UK's van fleet⁷.

Reasons for this lag are varied.

According to BEDEO research of van fleet operators:



36% perceive cost to be a barrier to electrification



34% note the lack of available electric vans



15% believe that electrification would reduce load space

Accelerating this transition is possible, however.

The Retrofit, Range-Extended Electric Van

Retrofit electric vehicles (EVs) equipped with in-wheel (hub) motors offer a pragmatic solution for fleets aiming to accelerate their transition to electric mobility.

More specifically, in a retrofit range-extended electric van (REEV), the existing combustion engine is maintained, but used only as a backup – but rarely so, as the available electric range of 73 miles in the Reborn Electric solution exceeds most daily usage – the average mileage a van travels per day is around 55 miles⁸. Geolocation technology used in advanced REEVs can furthermore ensure zero-emissions travel in urban environments, aligning with sustainability goals posed by companies and the government.

The integration of in-wheel motors, electronics, and braking systems are housed in the otherwise non-driven wheels, creating a true hybrid-electric van with full EV operational capability. While in-wheel motors necessitate some modifications to suspension and braking systems to accommodate additional weight and changes in vehicle dynamics, they in general do not sacrifice load volume – a critical consideration, especially for logistics and service fleets.



55 Miles

the average mileage a
van travels per day

The Retrofit, Range-Extended Electric Van

Generally, vans with existing diesel Euro 6 compliant drivetrains will have a usable lifespan of well over 100,000 miles, but their frame and body may well be serviceable for much longer. This means that fleet operators that have deployed vans with costly racking, passenger transport solutions, or refrigeration units face a daunting choice, half-way through the vehicle's lifecycle: replace the drivetrain, or buy a new vehicle, writing-off the fit-out and equipment. Neither is optimal for a company's CO2 footprint, nor budget.

By opting for retrofitted REEVs with hub motors, fleets can expedite their electrification efforts, minimise their environmental impact, and leverage existing vehicle stock. It's a lower-cost, pragmatic alternative, especially for SMEs operating within both budget and sustainability constraints.

Finally, retrofit solutions are, in general, better for drivers. Research by the University of York shows that electrified taxis yield drivers who are "calmer, less stressed and happier ... than in the old diesel model. The largest improvement over a diesel taxi reported by the drivers was increased happiness." Similarly the modern, range-extended London Black Cab, allows drivers to drive in electric mode – with smooth, emission-free, instant power – in urban areas, while having the flexibility of a range extender as redundancy.

BEDEO calls its solution, "TCO2" – combining both Total Cost of Ownership, and CO2 considerations.



A retrofit van is resilient, too. **Stephen Lambert, BEDEO Chief Technology Officer (CTO)**

explains, "The EV part of the drivetrain will still require around 90% less maintenance than the ICE engine. The battery is sealed for life, the motor is sealed with no maintenance requirement. There is very little additional maintenance requirement, and any garage can do it."



The Current and Future Policy Landscape

Efforts to encourage the purchase of new, electric vans in the UK are laudable, as they promote decarbonisation and cleaner air. However, they also in many cases mean potentially scrapping (often-times UK-built or UK-fitout) vans with a usable life, while subsidising the purchase of (mostly foreign-built) electric vans – with a higher initial carbon footprint.

Over its lifespan, an electric van will save over 30 tonnes of CO₂ when compared to a combustion-engined vehicle¹⁰. Nevertheless, the savings only fully take effect after the initial deficit of vehicle production is compensated – usually after two years of use¹¹.

Extending the life of existing vans, while reaping the benefits of electrification, would therefore seem to be a no-brainer – for the environment, for government, and for fleet operators. Yet the current UK legislative framework is less supportive than it could be.

While range-extenders are permissible and a way for fleet operators to effectively manage the transition, retrofit vans still lack standardised type-approval and are ineligible for many grants and subsidies. Furthermore, their lack of type approval means they are ineligible for use in LEZs across the UK.



Andrew Whitehead explains, “When you do a conversion and fill in a form, you need an individual vehicle approval (IVA). Today, you are required to re-register the vehicle, because it is changing the fuel-type of the vehicles.”



The Current and Future Policy Landscape

The UK's current Clean Vehicle Retrofit Accreditation Scheme (CVRAV) – updated in February 2024 – does not provide for an easy pathway for retrofit REEVs to operate in clean air zones, including London's ULEZ¹².

Neighbouring countries show a more progressive stance. In recognition that even if more than half of new vehicles being sold in France today were electric, only 30 percent of the fleet would be electric by 2035, regulations were changed in April 2020 to enable retrofit solutions to be homologated universally at the prototype stage, thereby granting entry into restricted access zones.

Furthermore, France provides incentives up to €8,000 per vehicle (above 5 years old), plus additional benefits, which can double for businesses in environmental zones and certain regions.



"The best way to reduce CO₂ overall is to keep vehicles on the road longer."

Stephen Lambert

A curious case of REEV legislative exceptionalism...

Subsidies for range-extended electric vehicles in the UK do exist, but only for the iconic London Black Cab. Engineered in its new iteration by LEVC, the TX boasts an electric-only range of just under 80 miles – usually enough for a full shift within the city. Just like a range-extended van, for longer trips, the Black Cab's range is extended by 250 miles via a built-in combustion engine.

Cabbies receive a federal Plug-in-Taxi Grant (PiTG) of 6,000 Pounds (from April 2024).

Policy Measures to Enable Electric Van Retrofits

To enable the greater adoption of retrofit solutions, five specific regulatory measures should be considered:

Streamlined approval processes: Simplify and expedite the current approval process for retrofit electric vans. Fleet operators should encounter minimal bureaucratic hurdles when converting their vehicles.

Accreditation schemes: Introduce pathways to type-approval and full accreditation specifically for retrofit electric vans. By certifying the quality and safety of retrofit technologies, fleet buyers will also have greater confidence in the reliability of these converted, electric vans.

Financial incentives: Extend financial incentives available to new and used BEVs for fleet operators who choose to retrofit their vans. These incentives could include grants, tax breaks, or rebates.

Promote collaboration between stakeholders: Promote engagement and exchange between UK retrofit manufacturers, fleet operators, and local authorities. By involving all relevant parties, regulatory measures can be tailored to address specific challenges faced by retrofit electric vans.

Research and development grants: Allocate funding for research and development related to retrofit technologies. Encourage innovation in conversion methods, battery technology, and efficiency improvements. Grants can spur advancements and drive competitiveness in the retrofit market.

Success for Fleet Operators: Deploying Retrofit REEVs

Technical considerations play a crucial role in determining the suitability of retrofit solutions for your fleet. Being able to maintain compatibility with existing infrastructure, such as maintenance and loading facilities, is a key factor to seamless integration. By maintaining existing vehicles instead of replacing them for new BEVs, fleet operators will face minimal adaptation requirements at docks and depots.

Similarly, maintaining the well-familiar vans also ensures comfort and confidence among van fleet drivers – while adding the benefits of a quieter, happier cab environment.

Collaborating with partners, including OEMs, converters, and regulators, facilitates a smooth transition to retrofit electric vans, unlocking the full potential of sustainable mobility for company fleets.

By evaluating these factors and leveraging strategic partnerships with qualified retrofit manufacturers, fleet operators can make informed decisions to optimising their fleet operations and embracing the benefits of retrofit REEVs.

When considering fleet electrification, full electric vans may come with a prohibitive cost for a whole fleet, whereas retrofit solutions can help to decarbonise quickly, cost-effectively and maximise total cost of ownership. It's a compelling option, especially for fleet managers overseeing highly customised van fleets in various industries. Utility and maintenance vehicles, including those used in telecommunications, cable, plumbing, and energy sectors, stand to benefit significantly from these solutions.



Success for Fleet Operators: Deploying Retrofit REEVs

Commercial shuttle services operating in hotels, airports, and corporate campuses can also reap the rewards of retrofitting, as they often have been extensively adapted for passenger comfort and convenience. Finally, mobile healthcare providers can leverage retrofit solutions to enhance their fleet of mobile clinics, ambulances, and fast-response medical vehicles. Retrofitting ensures compliance with safety standards while reducing environmental impact – a win-win for fleet managers prioritising both efficiency and sustainability.



Clinical waste company Medisort has chosen BEDEO's retrofit solution to electrify its Peugeot Boxer and Fiat Ducato vans as "Reborn Electric RE-100 Range Extender" models.

Medisort's retrofitted diesel vans now have 73 miles (117km) of electric range, meaning they'll drive in electric-only modes for all urban trips, while utilising the diesel engine just for longer journeys. At the heart of their vans is BEDEO's RE-100 retrofit solution, with two in-wheel motors developed and manufactured by BEDEO's group company Protean Electric and a 37 kWh battery.



"The ability to start our journey towards a greener, more sustainable future without jeopardising any of our key partners or clients is a huge step towards transforming our fleet and our operations to keep doing what we do, just in a more sustainable, flexible and cost-effective manner."

Stuart Brittle
Medisort Managing Director



Conclusion: Looking Ahead

Retrofit, range-extended vans fill a sizable gap in the market and provide fleet operators with a further option toward decarbonisation and the circular economy. "A new, fully electric vehicle will have a longer range. This isn't our segment, though. Our solution is unique, and conceived to bridge the gap, especially for highly converted vehicles," notes Osman Boyner, Founder and CEO of BEDEO.

"When you look ahead to 2030, I'm sure we'll move to 30 to 35 percent of new van sales being electric. This is great, but it also means that 65 to 70 percent will still be diesel in 2030 with a life expectancy of 10 years or more... so we see there is a huge need to convert the vehicles," he adds.

Currently, there are just few retrofit solutions providers, but a more regulated market will undoubtedly spawn many more manufacturers. Andrew Whitehead notes, "We are targeting battery sizes for daily operating ranges of around 60 to 70 miles. We think this addresses 70 percent of the usage in the segment."

Considering the compelling advantages of retrofit REEVs, it is now imperative for policymakers and stakeholders to take action to support and invest in enabling retrofit solutions for UK businesses. By enabling a "third way" for fleet managers through legislative support and incentives, the UK can empower businesses to embrace sustainable practices while maximising their operational efficiency.

Moreover, prioritising UK businesses in the development and deployment of retrofit solutions not only fosters economic growth but also strengthens the country's position as a leader in sustainable transportation. Through concerted efforts to accelerate the transition to retrofit electric vans, we can realise significant environmental benefits, drive innovation, and create a greener, more resilient future for all.

As Osman Boyner summarises, "Supporting the retrofit market in the UK also means supporting SMEs in the UK."



Appendix

1. SMMT data via RAC. 8.4 years represents the highest figure since records began in 2000. There are currently almost 10 million vehicles on UK roads registered before 2008.
2. <https://www.acea.auto/files/ACEA-report-vehicles-in-use-europe-2023.pdf>
3. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1065072/van-statistics-2019-to-2020.pdf
4. <https://bibliothec.ademe.fr/mobilite-et-transport/4590-etude-retrofit.html>
5. DVLA, December 2022, via GOV.uk
6. SMMT data. Sales data via Motorfinance Online, April 5, 2024 "UK's LCV market grows 11 percent to 52,916 units in March 2024"
7. SMMT data, issued January 5, 2024
8. Calculated using average van mileage from vanleasing.com (14,000) divided by working days in the year (260)
9. Lambert, Fred, Electrek May 15, 2018, "Electric vehicles reduce stress for drivers, says new brain monitoring study."
10. Approximate CO2 emissions savings, based on a lifecycle of 200,000 miles.
11. Average lifecycle emissions on BEV vs. ICE vehicles across Europe. Emissions vary, depending on fuel and energy source. Data via ICCT lifecycle assessment of greenhouse gas emissions, July 2021.
12. Energy Savings Trust, via <https://energysavingtrust.org.uk/service/clean-vehicle-retrofit-accreditation-scheme/>

All other research carried out independently by BEDEO.





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